

## 12.3 Stationary waves

**Preliminary work:** Finding resonant frequencies that make stationary waves on a cotton thread

**Computer simulation:** Swave

**Experiment:** Making stationary electromagnetic waves and measuring their frequency

**Full investigation:** Measuring the speed of sound by setting up longitudinal stationary waves in a column of air

### Preliminary work

#### Finding resonant frequencies that make stationary waves on a cotton thread

##### Apparatus

- vibration generator
- audio-signal generator
- connecting leads
- length of black thread
- clamp stand and rubber band
- stroboscope (if available)

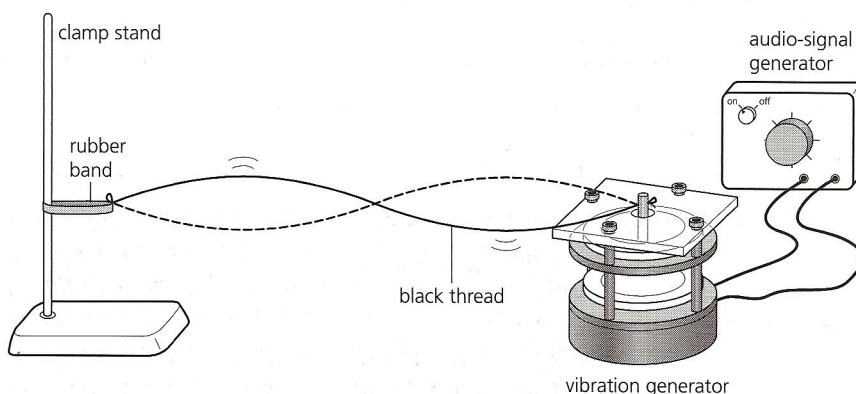


Figure 12.6

##### Plan

- Use the audio-signal generator to activate the vibration generator.
- Tie one end of the thread to the vibration generator and the other to the rubber band that has been hooked over the clamp stand (see Figure 12.6).
- Tension the thread by moving the stand and vibrator apart.
- Change the frequency of the generator until you see a single-loop stationary wave on the thread (the fundamental mode). Tune the frequency carefully to get maximum amplitude.
- Increase the frequency and find other modes of vibration. You should be able to get the second and third harmonic vibrations.
- Use the flashing light from the stroboscope to seemingly slow down the motion of the thread, so that you can see how it moves in detail.

##### Analysis

Draw careful pictures of the first three modes of vibration of the thread, showing the nodes, antinodes and wavelength of the waves. Use arrows to indicate the direction of motion of the different sections of the thread.